many mental and moral wrecks into happy and useful citizens." That was the answer he would give to Dr. Mapother.

In reply to Dr. Wohlgemuth, he had to find an analyst who would accept him for treatment, and he, Dr. Potts, would say he was not a fit case for the treatment.

Dr. Hart had shown, in his Goulstonian Lectures, that the Freudian treatment was a definite scientific treatment. But it was not necessary to discuss whether Jung's was scientific, because Jung said it was not a science, and so long as Dr. Wohlgemuth was trying to settle whether the system was right or wrong by the answer to the question of whether or not it was a science, it was useless to discuss with that gentleman the Jung point of view.

He was glad Dr. Ross said what he did about the misunderstanding Dr. Crichton Miller must have been under. It was of the utmost importance that anyone who did psychological work should make the most thorough physical examination. He himself would not take any person for psychological treatment without a thorough physical examination having been made first. He remembered the case of a man who had been going blind for several years, and who had been seen by a number of leading neurologists and eye specialists in London. When he came to the speaker it struck him that his was not a psychological case, and as soon as he (Dr. Potts) examined the man's throat he saw appearances which made him think of syphilis. A consulting physician agreed, and salvarsan injections were given, which did him much good. That man had been allowed to drift on for three years, suffering from optic neuritis, simply because each time the Wassermann was done it was negative. In another case a man was told that his only chance was psychological treatment, and sent to the speaker after two or three consulting surgeons had seen him. He was suffering from posterior gonorrhœal urethritis, which was cured by appropriate physical treatment.

Syphilis and Mental Disease.[1] By H. Ferguson Watson, M.D., D.P.H., F.R.S.E., Deputy Commissioner, General Board of Control for Scotland.

Introduction.

The *rôle* of syphilis in the causation of mental disease is of such importance that any investigation of the subject likely to elicit further data is obviously of great practical value, while available

[1] From the Manx Mental Hospital, Argyll and Bute Mental Hospital, and Bacteriology Department, University of Edinburgh.

https://doi.org/10.1192/bjp.72.299.573 Published online by Cambridge University Press

statistics relating to syphilis, as an ætiological factor in mental conditions, show discrepancies which indicate the need for such investigation on the widest possible basis.

In recent years the Wassermann serum reaction and the examination of the cerebro-spinal fluid by chemical and cytological methods have contributed greatly, by supplementing clinical data and personal histories of cases, towards the accurate diagnosis of mental and neurological conditions of syphilitic origin, and have proved a valuable asset in the study of the part played by syphilitic infection generally in the pathology of the nervous system.

It is now generally accepted that the recognition of syphilis by purely clinical methods, even in the active stages of the disease, may present considerable diagnostic difficulty, and in its latent phase the actual existence of the infection can only be demonstrated by laboratory diagnostic methods. In addition, serum diagnosis has contributed greatly to establishing the syphilitic ætiology of pathological conditions whose causation had long been regarded as doubtful.

The syphilitic factor in such conditions as general paralysis and locomotor ataxia is, of course, now well recognized, and the Wassermann reaction has undoubtedly established the syphilitic origin of these conditions. In fact, in no other phase of syphilis, with the exception of the secondary stage, is a positive Wassermann reaction more constant than in general paralysis.

The value, therefore, of the Wassermann reaction in any systematic study of the relationship of syphilis to mental disease generally is undoubted.

For a number of years the author has been engaged in a study of the syphilitic factor in various pathological conditions, and more recently further attention has been specially directed to this ætiological agent in mental disease. With the aid of sero-diagnostic methods, it is reasonable to suppose that in mental hospital populations a larger proportion of latent cases may be detected than was at one time possible, and the mode of investigation proposed has been to carry out systematic serum tests in all cases in particular mental hospitals and correlate the results with personal histories and clinical data, with a view to obtaining in this way the maximum of relevant information.

The object of this paper is to record the results obtained from such an investigation carried out in (*a*) the Manx Mental Hospital, where 290 cases were studied, and (*b*) the Argyll and Bute Mental Hospital, where 388 cases were studied. These may be regarded as collectively representative of the general types of mental disease met with in public mental hospitals in this country, but it is intended

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that, if possible, this communication should be followed by subsequent reports dealing with similar investigations in other selected mental hospitals.

Mental Hospital Statistics Relating to Mental Disease.

England.—In the Thirty-first Report of the Board of Control it is stated that in 1876 venereal disease was recorded as a cause of mental disease in 0·4% of the total admissions, being 0·6% for men and 0·2% for women. Among private male patients the percentage was 1·6, and for paupers it was only 0·3. In the Forty-fourth Report the yearly averages between 1879 and 1888 were for men 0·8% and for women 0·2%; among male private patients 1·8% and male paupers 0·6%. From 1888 to 1896 quinquennial averages are recorded, but after 1907 acquired and congenital syphilis are no longer quoted together.

Table I.

—	Private.		Rate-aided.	
	Male.	Female.	Male.	Female.
1879–1888 . .	1·8%	0·2%	0·6%	0·2%
1889–1892 . .	2·5%	0·2%	1·1%	0·4%
1893–1897 . .	4·2%	0·3%	1·8%	0·5%
1898–1902 . .	6·5%	0·3%	3·2%	0·8%
1903–1906 . .	8·3%	0·5%	4·8%	1·0%
1907 . .	12·0%	0·5%	7·3%	1·2%
1908–1912 . .	11·8%	0·7%	9·0%	1·3%

It will be observed that among the men the proportion is higher in the case of private than in pauper patients, while the converse obtains in women. With newer methods of investigation it was found that among 79,761 pauper patients 10·3% of the males and 1·6% of the females showed evidence of acquired syphilis. The incidence among males in some English mental hospitals is shown below:

Table II.

Mental hospitals with—			
(*a*) High percentage:		(*b*) Low percentage:	
Portsmouth . . .	28·3%	Salop	1·1%
Plymouth . . .	22·5%	Denbigh . . .	1·3%
Croydon . . .	20·4%	Derby County . .	2·0%
London County . .	20·0%	Westmorland and Cumberland	2·2%
Newcastle . . .	19·1%	Suffolk	3·1%
Cardiff	13·2%	Leicester and Rutland .	3·2%
Middlesex . . .	12·0%		

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Scotland.—Mackenzie (1913) submitted the sera of 786 mental hospital cases to the Wassermann test. Two hundred and thirty-four had been diagnosed as suffering from general paralysis and 94% gave a positive result. Of 126 cases tested before examination or clinical diagnosis 62% were positive. In 64 cases of imbecility 25% were found positive, while of the remaining 362 who showed no clinical evidence of syphilis 8·8% were positive.

Gilmour (1913), at the Glasgow District Mental Hospital, Gartloch, examined 129 cases of admissions, and found 21% positive among the women and 35·8% among the men. Of 176 female cases, which did not include paralytics, 14·7% were positive; and, again excluding paralytics, among the men 18% of his 173 cases were positive. Mackenzie further reports that of 258 admissions to Glasgow District Mental Hospital, 54 patients reacted positively to the Wassermann test; while for the same period there was not admitted to the Mental Hospital for the counties of Argyll and Bute a single case of general paralysis in which infection did not appear to have been contracted outside of these counties.

The Incidence of Syphilis in the Community Generally.

In any consideration of the incidence of syphilis among patients suffering from mental disease, it is, of course, necessary to correlate the results obtained with the facts regarding the incidence of the infection in the general population.

Since the introduction of the test by Wassermann, Neisser and Bruck (1906), there are now abundant statistics available for comparing the findings of the different workers.

White (1914), in his evidence before the Royal Commission on Venereal Diseases, basing his estimate upon a consideration of all available statistics, came to the conclusion that in the United Kingdom there were annually about 114,000 fresh cases of syphilis. In 1919, D. Watson estimated that in Scotland alone there were 27,000 new cases of syphilis annually. The figure is probably much too high; on the other hand, those of the Registrar-General (for Scotland) are probably too low, because an examination of his figures for the decade 1912-1921 shows that 2,011 deaths occurred —that is, just over 200 a year were due to syphilis—and we find that about 75% of the deaths were children under one year of age, and only 47 adults died of syphilis. It seems fairly certain that certification was at fault when, out of a population of 4¾ millions, only 47 adults died of syphilis, and yet more than three times as many children are certified as dying from that cause.

Perhaps a better estimate could be made from the death-rate for general paralysis and locomotor ataxia, because it is recognized

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that of those who contract syphilis 2·5% to 3% develop general paralysis or locomotor ataxia.

Mattauschek and Pilcz (1921) traced the cases of 4,134 officers of the Austrian Army infected between 1880 and 1900. By 1912 some 4·8% had developed general paralysis and 2·7% developed tabes. One has, however, to bear in mind that these diseases are more prevalent among men than women. Vedder (1918) states that in Denmark about 2·5% of cases that contract syphilis eventually die of general paralysis. If, then, we take 3% as representing the figure for those who eventually die of general paralysis or tabes, we may conclude that in Scotland the number of cases of syphilis per annum is in the region of 9,000.

The Royal Commission on Venereal Diseases (1916) puts the percentage at not less than 10 of the whole population of large cities, there being little difference between Scotland and England. Ferguson Watson (1912) investigated 331 cases of children and found 10% were syphilitic, as evidenced by the Wassermann test. Elliot (1914) examined 130 cases of children at the City of Glasgow Fever Hospital and obtained 10% positive reactions; among the series only 4 showed clinical evidence of syphilis. Greig (1923) examined about 100 girls at an industrial school in Dundee and obtained positive results in 73%. All improved under anti-syphilitic treatment. Laird (1923) examined 287 imbecile children in Baldovan Institution, Dundee, and, excluding all those who had manifested signs of syphilis, found 139 with a positive Wassermann reaction. Chislett (1911), in his examination of mentally defective children, obtained positive results in 45%. Ferguson Watson (1913) examined the sera of 105 defective children (*a*) under school age, (*b*) unfit for school by reason of their mental defect, and (*c*) markedly defective children seen while assisting Dr. Oswald, Glasgow Royal Hospital, with his investigation for the Royal Commission on the feeble-minded in 1907. Of the 105 cases examined 51 gave a positive Wassermann reaction—48·5%—and of that number 13·4% showed stigmata. Among the series were 14 Mongols, 3 of whom were positive. Stevens (1916) found 6 positive in his series of 18 Mongols. De Stefano (1920) found 34 positive out of 46 Mongols examined.

Serological Methods used in the Present Investigation.

The sera were examined by the Wassermann test and also by the more recently introduced flocculation reaction. The methods were those used in the Bacteriology Department, University of Edinburgh.

Wassermann reaction: Antigen.—This was prepared from sheep's heart, which was minced, finely ground with sand and then extracted with 96% absolute

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alcohol (20 grm. to 100 c.c. of alcohol); the extract was filtered and saturated with cholesterol.

Five antigens of different ages made by this method and one from ox heart were used in the tests. In each case the serum was tested with at least two different antigens, and in all doubtful cases six different antigens were used.

Technique.—The patient's serum was heated at 55° C. for half an hour. The hæmolytic system was ox's red blood-corpuscles (3 c.c. in 100 c.c. of 0·85% salt solution) sensitized with ox immune-body from the rabbit. Complement was obtained from a guinea-pig which had been killed 18 hours previously. The antigen for the test was made up in a 1 : 12 dilution with normal saline by slow admixture so as to form a turbid suspension. The M.H.D. of the complement for 0·5 c.c. of the sensitized blood suspension was estimated by preliminary test. Known negative and positive control sera were always included in each set of tests. The other necessary controls (antigen and serum) were also included. Readings were made after incubation and 12 hours later.

Flocculation test: Antigen.—This was the same as that used in the Wassermann test, and was made up in the form of a turbid suspension in saline (1 in 6).

Technique.—The patient's serum was inactivated at 55° C. for half an hour.

Into small test-tubes (3 × ½ in.) was placed 0·4 c.c. of each of the following dilutions, 1 in 2, 4, 8, 16, 32 and 64, and one half volume of antigen suspension was added, *i.e.*, 0·2 c.c. Ferguson Watson (1925) has shown the importance of shaking. Thus the tubes were placed in racks and transferred to the carrier of an electric shaker for 5 minutes before being incubated at 37° C. for 4 hours. Readings were made at the end of that time and at 12, 24 to 36 hours. Positive cases showed flocculation which could be noted by the naked eye, while negative cases and controls showed no change.

Results.

The number of cases examined was 678, and it was arranged that the laboratory tests should be completed before the history and clinical data were known to the author.

Of the 678 cases examined, 290 were from the Manx Mental Hospital and 388 from Argyll and Bute Mental Hospital. The comparative results in the case of the Manx Hospital are shown below:

Table III.

Manx Hospital.	Number of cases examined.	Positive both reactions.	Negative both reactions.	*W.R. + F.T. −.	W.R. − F.T. +.
Male . . .	141	23	117	0	1
Female . . .	149	23	124	0	2
Total . . .	290	46	241	0	3

* W.R. = Wassermann reaction. F.T. = Flocculation test.

One male and one female case of feeblemindedness and one case of manic-depressive insanity were positive to the flocculation test and negative with the Wassermann reaction. The mental conditions of the remainder are classified in the table:

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TABLE IV.

—	Positive reaction.			Negative reaction.			Total cases tested.
	Male.	Female.	Total.	Male.	Female.	Total.	
Acute confusional insanity	—	—	—	3	1	4	4
Dementia . . .	4	3	7	15	14	29	36
Dementia præcox . .	4	6	10	29	26	55	65
Epileptic insanity . .	1	2	3	7	4	11	14
Feebleminded . .	6	7	13	32	38	70	83
,, with epilepsy	—	—	—	—	2	2	2
General paralysis . .	1	—	1	—	—	—	1
Mania	—	1	1	4	—	4	5
Manic-depressive . .	3	2	5	9	16	25	30
Melancholia . . .	1	—	1	4	4	8	9
Paranoia . . .	3	2	5	12	18	30	35
Miscellaneous . .	—	—	—	2	1	3	3
Totals . . .	23	23	46	117	124	241	287

Of the 290 cases examined 141 were men and 149 were women. Twenty-three of each sex gave positive results in both tests, or 16·31% for male patients and 15·43% for females—an average of 15·87%. If one case of general paralysis is excluded the percentage falls to 15·60% or to an average of 15·51% for both sexes. A history of syphilis or clinical evidence was present in 3·7%.

The table shows the result of the examination of the 388 cases in the Argyll and Bute Mental Hospital:

TABLE V.

Argyll and Bute Mental Hospital.	Number of cases examined.	Positive both reactions.	Negative both reactions.	*W.R. + F.T. −.	W.R.− F.T.+.	W.R.− †F.T.
Male	185	39	139	0	0	7
Female . . .	203	33	169	0	1	0
Total . . .	388	72	308	0	1	7

* W.R. = Wassermann reaction. F.T. = Flocculation test.

† In these 7 cases classified as "weakly positive" a trace only of flocculation was noted with the 1 in 2 and 1 in 4 dilution of serum. While known negative sera do not exhibit any change even in a 1 in 2 dilution, it is difficult to assess at present the diagnostic significance of the weak reactions observed in these 7 cases.

One female case of melancholia gave a negative Wassermann reaction and a positive flocculation test. Seven male cases that

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gave negative Wassermann results were weakly positive in the flocculation test. Four of these were cases of dementia præcox, 2 were feebleminded and 1 was a case of confusional insanity. Three of the cases had previously been resident in institutions, while 2 were ex-soldiers. The mental conditions of the remainder are shown in the following table:

TABLE VI.

—	Positive reaction.			Negative reaction.			Total cases tested.
	Male.	Female.	Total.	Male.	Female.	Total.	
Acute confusional insanity	—	2	2	—	1	1	3
Dementia . . .	7	2	9	22	44	66	75
Dementia præcox . .	15	6	21	45	41	86	107
Epileptic insanity . .	—	1	1	1	2	3	4
Feebleminded . .	5	2	7	26	14	40	47
,, with epilepsy	—	—	—	—	3	3	3
General paralysis . .	2	1	3	—	—	—	3
Mania	1	2	3	2	4	6	9
Manic-depressive . .	2	2	4	14	11	25	29
Melancholia . . .	1	5	6	9	19	28	34
Paranoia. . . .	6	9	15	19	27	46	61
Miscellaneous . .	—	1	1	1	3	4	5
Totals . . .	39	33	72	139	169	308	380

185 men and 203 women were examined, and 39 of the former and 33 of the latter gave positive results in both tests, giving percentages of 21·08 and 16·25 respectively. If the cases of general paralysis are deducted then the men are 20·00% and the women 15·76%, or 17·88% average for both sexes (18·66% if paralytics are included). One male case of mania seems to be an incipient case of general paralysis. The percentage of cases which gave a history of syphilis or showed clinical evidence was 2·83.

DISCUSSION.

All the figures available are not strictly comparable with mine. Those for England are not of recent date, while those for Scotland deal with admissions only, and therefore may include a higher proportion of recent infections, while my investigations deal principally with latent cases.

This investigation shows that, taking both sexes together for each hospital, the Argyll and Bute Mental Hospital would come sixth on the list when compared with those shown in Table II, and the Manx Hospital would also be placed sixth on the same list. The

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former, however, with 18·66%, is comparable to Newcastle with 19·1%, and the latter with 15·87% stands relatively nearer Cardiff, which has 13·2%. Therefore, taking the English standard, both hospitals would be returned as with a high percentage.

In his investigation of 786 cases of admission, Mackenzie had 62% among 126 cases which were tested by laboratory methods before diagnosis and examination had been made, and 8·8% in his 362 cases which showed no clinical evidence of syphilis. In a further series of 258 cases 20·93% were positive, which is 2·3% higher than that found at Lochgilphead and 5·1% above the Douglas Hospital. Gilmour's figures were 28·40% for both sexes in his examination of 129 admissions. It is of special interest to note that in both Argyll and Bute and in the Manx Hospitals general paralysis was rarely seen in the past, but at the present time there are 2 men and 1 woman in the former hospital and 1 man in the latter—percentages in both instances which are very low indeed, and at present one might have such difficulty in finding a correct explanation that it is better not to seek one.

Summary.

Manx Mental Hospital.—The number of cases examined was 290, of whom 46 gave positive results—23 men and 23 women; 241 were negative—117 men and 124 women; while 1 man and 2 women were positive with the flocculation test and negative with the Wassermann reaction. The male patients gave positive results in 16·31% and the female in 15·43%.

Argyll and Bute Mental Hospital.—The number of cases examined was 388—185 men and 203 women—and 39 of the former and 33 of the latter gave positive results. 139 men and 169 women gave negative results, while one woman was positive with the flocculation test and negative with the Wassermann reaction. 7 men gave a doubtful reaction with the flocculation test but were negative with the Wassermann reaction. The same result was obtained when these cases were tested one month later—altogether with six different antigens. The male patients gave positive results in 21·08% and the women in 16·25%.

Conclusions.

1. In this series of cases studied, the flocculation test, if not superior to the Wassermann reaction, has been proved to be in no way inferior, and its application is much simpler.

2. The investigation suggests that while syphilis in mental hospitals is more common among men than among women, there is not such a wide difference as was at one time supposed.

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3. By means of laboratory methods it can be demonstrated that the incidence of syphilitic infection is much greater than had been suspected. The percentage has been raised by 12·1 in the case of the Manx patients and by 15·0 for the Scottish hospital.

4. Better conclusions can be arrived at when a greater number of mental hospitals are available for comparison, but a true index can only result if the observations are made by the same author.

I am indebted to Dr. Skene, Superintendent of the Manx Mental Hospital, and Dr. Ross, Superintendent of Argyll and Bute Mental Hospital, for giving me the opportunity of carrying out this investigation in their hospitals, and I am especially indebted to Prof. Mackie for facilities in connection with the laboratory work.

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Mendelism in Bacteriology.[1]

By F. H. Stewart, M.A., D.Sc., M.D., D.P.M., Major I.M.S. (ret.), Assistant Medical Officer, Cheddleton Mental Hospital.

The studies which I wish to bring to your notice were begun with the object of finding some bacterial cause for manic-depressive insanity. This problem has, of course, engaged other laboratories. I would refer particularly to the work done in the Cardiff Laboratory, which has been described by Goodall in the Journal of this Association.

Our work in Cheddleton was given a particular direction by the first case examined, in which we found a very striking change in the intestinal flora—a change which developed and receded in exact parallelism with the maniacal exacerbations. During the attacks *Bacillus coli communis* disappeared from the fæces, and two microbes known as *Bacterium coli mutabile* and *Bacillus paracoli* appeared in

[1] A paper presented at the Annual Meeting held in London July 15, 1926.

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